OUTLINE SHEET 3-5-1
Tanks and Voids

A. Introduction

Tanks are used to hold fluids vital for the ships' operation. This lesson will help you learn how tanks are used onboard ships.

B. Enabling Objectives

3.13 **STATE** the functions of tanks and voids.

3.14 **DESCRIBE** the basic types and component parts of tanks and voids.

3.15 **DETERMINE** the content of a tank in gallons given a sounding tape reading and sounding charts.

3.16 **DESCRIBE** the procedures for testing fuel oil tanks for presence of water.

3.17 **STATE** the safety precautions to be followed when in an enclosed space.

C. Topic Outline

1. Introduction
2. Overview
3. Fuel Oil Tank
4. Lube Oil Tank
5. Voids
6. Collection, Holding and Transfer Tank
7. Potable Water Tank
8. Feedwater Tank
9. Ballasting Tank
10. Summary and Review
11. Assignment

ASSIGNMENT SHEET 3-5-2
Tanks and Voids

A. Introduction

This material is to be completed prior to the material being covered in class.

B. Enabling Objectives

Refer to enabling objectives in Outline Sheet 3-5-1.

C. Study Assignment

1. Read Information Sheet 3-5-3

D. Study Questions

1. List three types of tanks used to contain fuel oil.
2. What type of tanks are unsuitable for use with sounding tubes?
3. Who is allowed to give permission to allow entry into an IDLH space?
4. What methods are used to check fuel oil for water?
5. What is used to remove water from ballasting tanks?

INFORMATION SHEET 3-5-3
Tanks and Voids

A. Introduction

This information describes tanks and voids.

B. Reference

NSTM Chapter 541
NSTM Chapter 079 V2
NSTM Chapter 262R3
NSTM Chapter 090
Fireman NAVEDTRA 12001

C. Information

I. Fluids such as oil, water and gasses are kept in tanks.
II. Fuel oil tanks are used to hold fuel oil.
    A. Fuel oil storage tanks hold fuel as it is loaded onto the ship, before it is cleaned for use.
    B. Fuel oil service tanks hold fuel oil for immediate use by propulsion equipment such as boilers, diesel engines, and gas turbines.
    C. Contaminated oil tanks are used to hold oil that is contaminated with water or other impurities.
III. Fuel oil tanks have the following components:
    A. Fuel oil is discharged into and taken from the fuel oil tanks through tailpipes.
        1. Stripping system tailpipe - draws from the bottom of the tank to ensure that water and particles that settles at the bottom is removed or “stripped”.
        2. Transfer system tailpipe - draws from above the stripping tailpipe.
        3. Service system tailpipe - takes suction higher in the service tank to avoid suction of any water and particles that had settled at the bottom.
    B. Vent pipes allow air to enter and exit while the fuel oil tanks are filled and emptied. Vent pipes run from the topmost points of fuel tanks to the weather decks.
    C. Sounding tubes are used for determining the liquid level in the tanks and for taking samples.
        1. The sounding tube extends a few inches from the bottom of the tank, through its top, and up to a space where it is convenient to access the tube.
        2. Sounding tubes are NOT installed in tanks that are kept under pressure.

D. Fuel oil in tanks is measured by a tank gauge, or a graduated sounding rod or tape with the use of a tank table.

E. Tank level-indicating (TLI) systems show the volume or weight of fuel oil in tanks.
   1. Magnetic float level-indicating systems in tanks that overflow directly overboard have high level alarms. The alarm point is intended to give a two-minute warning that the tank will overflow unless filling is stopped.
   2. Magnetic float level-indicating systems used in service tanks have low-level alarms that is set to give operators enough time to shift suction. Since service tanks are usually drawn down only to 50% of capacity, low-level alarms will not actuate in normal operations.

F. Smaller fuel tanks have sight glasses instead of TLI systems.
   1. Direct reading sight glasses are vertical glass tubes that are piped into the tank at both ends.
   2. The fuel oil level in the tank is directly indicated on the glass tube.
   3. The cutout valves are kept closed and are opened only when taking readings. This is done to prevent fuel leakage if the sight glass is broken.

G. Indirect-reading sight glasses use a vertical pipe with a magnetic float that rides on the surface of the fuel oil. The float raises small flags outside the pipe to indicate fuel level.

H. Tank access covers allow entry into the tank.
   1. Any fuel oil tank is considered “Immediately Dangerous to Life and Health” (IDLH) regardless of readings until the tank has been emptied, cleaned, ventilated, and certified as “Safe for Personnel” by the Gas Free Engineer.
   2. Entry into IDLH spaces is prohibited under normal operations. In an emergency, such as rescue efforts or emergency repairs, entry may be made if permission is granted by the CO.
   3. The Gas Free Engineer shall personally specify the required items for safe entry into an IDLH space:
      a) respiratory protection
      b) tools and equipment
      c) personal protective equipment
      d) fire extinguishing equipment
      e) emergency rescue provisions

IV. The sounding tape, also known as gauging tape, consists of a tape with a non-sparking plumb bob.
   A. The tape is lowered into the tank through its sounding tube until the tape tension changes as a result of the plumb bob contacting the bottom.
   B. The tape is rewound to the point wetted by the liquid in the tank.
   C. The corresponding volume is obtained using a tank capacity curve or a tank sounding table (also known as tank table).

V. Several methods are used to test a fuel oil tank for the presence of water.
   A. Water indicating paste - the sounding tape is coated with this paste to the level where water is expected. It will change from white-yellow to red when it comes in contact with water. It is NOT a reliable nor accurate method of determining the presence of water in fuel oil.
   B. Sampling - the sample taken from the bottom of the tank is checked for presence of water. Visible droplets indicate water contamination.
      1. Sample that is cloudy or hazy but has no visible water droplets may be contaminated with water. These samples are allowed to sit for 5 minutes.
         a) If the sample clears from top to bottom, the cloudiness is due to water contamination.
         b) If the sample clears from bottom to top, the cloudiness is due to entrained air.
      2. Fuel oil samples are also run through a centrifuge to separate sediment and water from the oil. This process, called Bottom Sediment and Water (BS&W) test, is used to measure the level of contamination of the oil.

VI. Various types of tanks are used to hold lube oil.
   A. Stowage tanks are used to store new or renovated oil.
   B. Settling tanks are used to allow water and other impurities to settle out of the oil. Used lube oil may also be temporarily stored in these tanks.
   C. Sumps or oil pans are used to collect oil as it drains from the engines, gears, and bearings.

VII. Voids are empty, watertight compartments separating other compartments. These spaces must be certified as “Safe for Personnel” prior to entry.

VIII. The Collection, Holding, and Transfer (CHT) system is designed to provide the capacity to hold shipboard sewage generated over a 12-hour period.
   A. The CHT system is designed to accept soil discharge from water closets and urinals and waste discharge from showers, laundries, and galleys.
   B. The sewage collected is held in holding tanks (CHT tanks) until it is transferred or discharged from the ship.

IX. Potable water tanks are used to store drinkable water.
   A. Fresh water is stored in special tanks located low in the ship.
   B. Potable water tanks are specially constructed and situated to prevent contamination.
      1. The fill connections are at least 18 inches off the deck and clearly marked “POTABLE WATER ONLY."
      2. The fill lines are not allowed to be cross-connected with any other system.
      3. Relief valves are provided on the fill piping to protect the piping and tanks from over pressurization while filling.
      4. All potable water tank sounding tubes are provided with valves or caps with padlocks. The valve or cap shall be locked closed when not in use.

X. Feedwater tanks are used to hold water for use by the boilers.

XI. The ballasting system allows fuel and certain other tanks to be filled with seawater.
   A. Ballasting is used:
      1. to maintain proper list, trim and draft
      2. to provide stability
      3. for protection from torpedo
   B. These tanks are generally flooded or filled with seawater from the firemain system through a manifold.
   C. Ballast water is removed from tanks with the use of drainage eductors and/or fire-and-bilge pumps.